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| 09/924,934 | 08/08/2001 | Matthew C. Mattina | 1662-38300 JMH (P01-3570) | 3940 |
| 22879 7590 04/04/2008 HEWLETT PACKARD COMPANY P O BOX 272400, 3404 E. HARMONY ROAD INTELLECTUAL PROPERTY ADMINISTRATION FORT COLLINS, CO 80527-2400 | | | | |
| EXAMINER ANYA, CHARLES E | | | | |
| ART UNIT | | PAPER NUMBER | | |
| 2194 | | | | |
| NOTIFICATION DATE | | DELIVERY MODE | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

09/924,934

Applicant(s)

MATTINA ET AL.

Examiner

Charles E. Anya

Art Unit

2194

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3/MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16, 18, 19, 21-26 and 28-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 18, 19, 21-26 and 28-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notices of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. Claims 1-16,18,19,21-26 and 28-34 are pending in this application.

Claim Objections

2. **Claims 1-16,18,19,24-27 and 28-34 are objected to because of the following informalities:**

Claims 1,13 and 24 do not include period (".") to indicate an end to the claims.

The comma "," used at the end of the claims may have been used in error.

For purpose of this office action the Examiner would replace the comma "," at the end of each of the claims with a period ".".

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. **Claims 1,13,16 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 5,887,138 to Hagersten et al. in view of U.S. Pat. No. 6,275,907 B1 to Baumgartner et al.**

4. As to claim 1, Hagersten teaches a distributed multiprocessing computer system, which includes a plurality of processors each coupled to an associated memory module, wherein each associated memory module may store data that is shared between said processors (figures 1-2), said system comprising: a Home processor that includes a memory block and a directory for said memory block in an associated memory module (Home Node/SMP 12 (Directory 66/Memory 22) Col. 7 Ln. 6 – 61, figure 2 Col. 10 Ln. 59 – 67, Col. 14 Ln. 13 – 24); an Owner processor that includes a cache memory (Requesting Node/SMP12 (External Caches 18) Col. 7 Ln. 6 – 47, Col. 8 Ln. 10 – 29), and wherein said Owner processor obtains an exclusive copy of said memory block, and stores said exclusive copy of said memory block in said cache memory (“...cache data...” Col. 9 Ln. 18 – 25, Col. 9 Ln. 54 – 57, “...read/write...” Col. 13 Ln. 21 – 30, “When clear...not written the updated copy...” Col. 15 Ln. 33 – 39); and wherein said Owner processor may displace the exclusive copy of said memory block, and return said displaced copy of said memory block to said Home processor (“Write back...” Col. 15 Ln. 32 – 36, Col. 24 Ln. 11 – 16) with a signal indicating that said Owner processor remains a sharer of said memory block (“...discarded...shared state...without acquiring the owned state...” Col. 13 Ln. 21 – 39, “...write stream transaction to a shared...” Col. 24 Ln. 16 – 23).

Hagersten is silent with reference to wherein said Owner processor begins write operations on said memory block and then displaces the exclusive copy of said memory block from said cache memory prior to completing the write operations said Owner processor returns said displaced copy of said memory block to said Home processor

with a signal indicating that said Owner processor remains a sharer of said memory block.

Baumgartner teaches wherein said Owner processor begins write operations on said memory block and then displaces the exclusive copy of said memory block from said cache memory prior to completing the write operations on said memory block, and in response to displacing said memory block prior completing the write operations said Owner processor returns said displaced copy of said memory block to said Home processor with a signal indicating that said Owner processor remains a sharer of said memory block (“...reserved cache line is set to...shared...” Col. 2 Ln. 52 – 55, Col. 16 Ln. 16 – 24).

It would have been obvious to one of ordinary skill in the art at the time invention was made to modify the system of Hagersten with the teaching of Baumgartner because the teaching of Baumgartner would improve the system of Hagersten by providing a cache coherence mechanism utilized to manage processor reservations in cases in which a reserving processor's cache hierarchy does not hold a copy of the reserved cache line (Baumgartner Col. 6 Ln. 20 – 22).

5. As to claims 13 and 24, see the rejection of claim 1 above.
6. As to claim 16, Hagersten teaches the method of claim 13, wherein the act of updating the coherence directory includes modifying a register to indicate that the

Owner processor has an exclusive copy of the memory block (“...updates...” Col. 19 Ln. 28 – 30).

7. Claims 2,3,14,15,21,22,25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 5,887,138 to Hagersten et al. in view of U.S. Pat. No. 6,275,907 B1 to Baumgartner et al. as applied to claims 1,13 or 24 above, and further in view of U.S. Pat. No. 6,141,734 B1 to Razdan et al.

8. As to claim 2, Hagersten teaches the directory associated with the Home processor indicates that said Owner processor has obtained exclusive control of said memory block (Directory 66 Col. 19 Ln. 15 – 34).

Baumgartner and Hagersten are silent with reference to the distributed multiprocessing computer system of claim 1, wherein said Owner processor obtains an exclusive copy of said memory block by issuing a Load Lock instruction.

Razdan teaches the distributed multiprocessing computer system of claim 1, wherein said Owner processor obtains an exclusive copy of said memory block by issuing a Load Lock instruction (Col. 4 Ln. 38 – 55).

It would have been obvious to one of ordinary skill in the art at the time invention was made to modify the system of Baumgartner and Hagersten with the teaching of Razdan because the teaching of Razdan would improve the system of Baumgartner and Hagersten by allowing for techniques to streamline processing within the CPU, while at the same time attempting to reduce the total number of memory accesses.

9. As to claim 3, Hagersten teaches the distributed multiprocessing computer system of claim 2, wherein said Owner processor executes multiple threads concurrently (the sharer state indicates that more than one slave agent 104/home agent 102 could access the same memory at the same time, which in essence means that multiple slave agent 104/home agent 102 of each SMP node 12A-D would be executing parallel/concurrently), and may displace data associated with a non-executing thread from its associated cache memory (“...discarded...” Col. 13 Ln. 21 – 39).

10. As to claims 14,15 and 25, see the rejection of claim 2 above.

11. As to claim 21, see the rejection of claims 1,5 and 19 above.

12. As to claim 22, Hagersten teaches the method of claim 21, wherein the Home processor invalidates all other shares when it sends an exclusive copy to the memory block to the Owner processor (“...owned...” Col. 13 Ln. 23 – 30).

13. As to claim 26, see the rejection of claims 3 above.

14. Claims 4,5,7,8,18,19 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 5,887,138 to Hagersten et al. in view of U.S. Pat. No. 6,275,907 B1 to Baumgartner et al., and further in view of U.S. Pat. No.

6,141,734 B1 to Razdan et al. as applied to claims 3 or xx or xx above, and further in view of U.S. Pat. No. 6,185,658 B1 to Arimilli et al.

15. As to claim 4, Razdan, Baumgartner and Hagersten are silent with reference to the distributed multiprocessing computer system of claim 3, wherein said Owner processor includes a register in which, an address is stored representing the memory block obtained in response to the Load Lock instruction, and wherein said Owner processor compares the address of any displaced data with the address stored in said register.

Arimilli teaches the distributed multiprocessing computer system of claim 3, wherein said Owner processor includes a register in which, an address is stored representing the memory block obtained in response to the Load Lock instruction, and wherein said Owner processor compares the address of any displaced data with the address stored in said register (“...comparing a requested address with...” Col. 5 Ln. 62 – 67, Col. 6 Ln. 1 – 22, Col. 9 Ln. 30 – 35, Col. 10 Ln. 1 – 7).

It would have been obvious to one of ordinary skill in the art at the time invention was made to modify the system of Razdan, Baumgartner and Hagersten with the teaching of Arimilli because the teaching of Arimilli would improve the system of Razdan, Baumgartner and Hagersten by providing a victim selection mechanism for efficiently selecting a cache line for deallocation (Arimilli Col. 6 Ln. 20 – 22).

16. As to claim 5, Arimilli teaches the distributed multiprocessing computer system of claim 4, wherein the Owner processor asserts a Victim To Shared message if the address of any displaced data matches the address stored in said register (“...assigning...cache coherency states...” Col. 5 Ln. 62 – 67, Col. 6 Ln. 1 – 22, Col. 9 Ln. 30 – 35, Col. 10 Ln. 1 – 7).

17. As to claim 7, Arimilli teaches the distributed multiprocessing computer system of claim 1, wherein the directory associated with the Home processor indicates that said Owner processor has become a sharer of said memory block in response to receiving said signal from said Owner processor (“...assigning...cache coherency states...” Col. 5 Ln. 62 – 67, Col. 6 Ln. 1 – 22, Col. 9 Ln. 30 – 35, Col. 10 Ln. 1 – 7).

18. As to claim 8, Hagersten teaches the distributed multiprocessing computer system of claim 7, wherein said Owner processor subsequently re-obtains an exclusive copy of said memory block to complete execution of the non-executing thread (“...without acquiring the owned state...” Col. 13 Ln. 39 – 42).

19. As to claim 18, see rejection of claims 5 and 7 above.

20. As to claim 19, Hagersten teaches the method of claim 18, further comprising the act of updating the coherence directory to indicate that said Owner processor has

become a sharer of said memory block in response to said Victim to Shares message (“...shared state...” Col. 13 Ln. 39 – 40).

21. As to claims 28,29 and 30, see the rejection of claims 5,7 and 8 respectively.

22. Claims 9 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 5,887,138 to Hagersten et al. in view of U.S. 6,275,907 B1 to Baumgartner et al. and further in view of U.S. Pat. No. 6,141,734 B1 to Razdan et al., and further in view of U.S. Pat. No. 6,185,658 B1 to Arimilli et al as applied to claims 8 or 24 above, and further in view of U.S. Pat. No. 6,266,744 B1 to Hughes et al.

23. As to claim 9, Razdan, Baumgartner, Arimilli and Hagersten are silent with reference to the distributed multiprocessing computer system of claim 8, wherein the Owner processor asserts a Read-with-Modify Intent Store Conditional instruction to the Home directory to again request an exclusive copy of said memory block.

Hughes teaches the distributed multiprocessing computer system of claim 8, wherein the Owner processor asserts a Read-with-Modify Intent Store Conditional instruction to the Home directory to again request an exclusive copy of said memory block (“...read with modify...” Col. 42 Ln. 47 – 58).

It would have been obvious to one of ordinary skill in the art at the time invention was made to modify the system of Razdan, Baumgartner, Arimilli and Hagersten with

the teaching of Hughes because the teaching of Hughes would improve the system of Razdan, Baumgartner, Arimilli and Hagersten by avoiding deadlock in multiprocessor systems for cases in which two or more processors are attempting to obtain ownership of a particular cache (Hughes Col. 39 Ln. 36 – 43).

24. As to claim 31, see the rejection of claim 9 above.

Allowable Subject Matter

25. Claims 6,10-12,23 and 32-34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Response to Arguments

Applicant's arguments with respect to claims 1-34 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Pat. No. 7,069,360 B1 to Lenoski et al.: directed to providing shared and non shared access to memory in a system with plural processor coherence domains.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles E. Anya whose telephone number is 571-272-3757. The examiner can normally be reached on 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Thomson can be reached on 571-272-3718. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2194

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

cea.

/VAN H NGUYEN/

Primary Examiner, Art Unit

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